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09/683,336	12/14/2001	David S. Hardin	01H1533	8636

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EXAMINER

ZHEN, LI B

ART UNIT	PAPER NUMBER
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2194

DATE MAILED: 12/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/683,336	Applicant(s) HARDIN ET AL.	
	Examiner Li B. Zhen	Art Unit 2194	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-38 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-38 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Claims 1 – 38 are pending in the application.

Response to Amendment

2. Applicant's amendments to claims 1 – 28 overcame the 35 U.S.C. 101 and 35 U.S.C. 112, second paragraph rejections and these rejections are withdrawn. The amendments to claims 1 – 38 also overcame the prior art rejections based on the Murase and Dingwall references. Accordingly, the prior art rejections based on Murase and Dingwall are also withdrawn. However, the current amendments did not overcome the prior art rejections based on Gee; therefore, the claims remain rejected as being anticipated by Gee. See the "Response to Arguments" section below for examiner's response to applicant's argument with regards to the Gee reference.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1 – 38 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,374,286 to Gee et al. [hereinafter Gee, cited in the previous office action].**

5. As to claim 1, Gee teaches a method for managing interrupts [An 16-input priority interrupt controller 272; col. 10, lines 43 – 50] in a multiple virtual machine environment [three JVMs, designated as JVM0, JVM1 and JVM2, Fig. 12; col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29], comprising the steps of:

running concurrently a plurality of independent virtual machines [col. 23, line 65 – col. 24, line 18] on a single processor [context switch operation is used to implement multiple JVMs which operate concurrently on a single processor; col. 23, lines 19 – 29], each virtual machine having associated therewith a plurality of anticipated interrupt signal types [services any interrupts which have occurred and queues the next partition to assume processor control; col. 23, lines 30 – 55];

receiving a plurality of interrupt signals [inputs are captured in a storage register (not shown) and a mask (MASK) from the register file 204 determines which interrupts will be recognized; col. 10, lines 43 – 50];

determining which interrupt signal of the plurality of received interrupt signals has the highest priority [priority encoder (not shown) generates the identifying number of the highest-priority unmasked interrupt; col. 10, lines 43 – 50]; and

servicing the interrupt signal determined to have the highest priority [col. 21, lines 37 – 43; proxy thread handles JVM-specific interrupts, col. 3, line 57 – col. 4, line 3];

wherein the multiple virtual machines of the multiple virtual machine environment are running on a single processor [context switch operation is used to implement multiple JVMs which operate concurrently on a single processor; col. 23, lines 19 – 29] and the method is performed on a single integrated circuit chip [col. 21, lines 43 – 57 and col. 33, lines 46 – 55].

6. As to claim 29, Gee teaches an interrupt management system [col. 10, lines 43 – 50] for an apparatus capable of running multiple concurrent virtual machines [col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29] on a single [col. 23, lines 19 – 29], real-time, embedded processor system [col. 21, lines 43 – 50], comprising:

an integrated circuit chip [col. 21, lines 43 – 57 and col. 33, lines 46 – 55]
comprising:

a timer component comprising a plurality of virtual machine timers [partition interval timer 1712; col. 28, lines 45 – 52], said timer component further comprising an active virtual machine switch signal output [1712 is only loaded via a load register 1714 which specifies the time interval for the next partition time slice; col. 28, lines 52 – 67];

a multiple virtual machine control component [partitions are controlled by a "master" JVM which always operates in partition 0; col. 23, lines 19 – 29], comprising an active virtual machine identification signal output [proxy thread then pushes the flags and JVM ID onto the stack and executes a resumeJVM instruction which starts the actual JVM thread for the partition; col. 23, lines 30 – 44];

a processor component [JEM processor 100, Fig. 1; col. 8, line 57 – col. 9, line 3 and col. 9, lines 18 – 26], coupled with said timer component [col. 28, lines 45 – 52];

an interrupt controller component [col. 10, lines 43 – 50] coupled with said processor component and with said timer component, said interrupt controller component comprising an active virtual machine identification signal input [active partition ID is maintained by a single partition register 1746; col. 30, lines 55 – 67] coupled with said active virtual machine identification signal output [col. 11, lines 18 – 38], said interrupt controller component also comprising an interrupt signal input [16-input priority interrupt controller; col. 10, lines 43 – 50]; and

a memory component storing interrupt handler code [interrupt handler thread of control; col. 24, lines 37 – 43].

7. As to claim 35, Gee teaches an interrupt controller [col. 10, lines 43 – 50] for a multiple virtual machine environment [col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29] running concurrently on a single [context switch operation is used to implement multiple JVMs which operate concurrently on a single processor; col. 23, lines 19 – 29], real-time, embedded processor system [col. 21, lines 43 – 50] and a single integrated circuit chip [col. 21, lines 43 – 57 and col. 33, lines 46 – 55], comprising:

an interrupt signal input [16-input priority interrupt controller; col. 10, lines 43 – 50];

a plurality of virtual interrupt latch components coupled with said interrupt signal input [data and address interface 262 and 242, address incrementers 236, instruction register 266, parsing logic 270, the arithmetic-logic unit (ALU) 256, shifters 254, and a multiport register file 204; col. 10, lines 43 – 57]; and

a plurality of global interrupt mask registers [a mask to the interrupt controller; col. 10, line 57 – col. 11, lines 9];

wherein each global interrupt mask register of said plurality of global interrupt mask registers is coupled with one of the virtual interrupt latch components [col. 20, line – col. 21, line 5].

8. As to claim 38, Gee teaches a processor-based interrupt signal management system [col. 10, lines 43 – 50] for a multiple virtual machine environment [col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29] running concurrently on a single [col. 23, lines 19 – 29], real-time, embedded processor system [col. 21, lines 43 – 50], comprising:

an integrated circuit chip [col. 21, lines 43 – 57 and col. 33, lines 46 – 55], comprising:

a processor component [col. 8, line 57 – col. 9, line 3];

a multiple virtual machine management [col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29] component coupled with said processor component, said multiple virtual machine management component comprising a plurality of virtual machine activation timer components [partition interval timer 1712; col. 28, lines 45 – 52];

a memory component [memory 104, Fig. 1; col. 8, line 57 – col. 9, line 3] coupled with said processor component, said memory component comprising interrupt handler code [interrupt handler thread of control; col. 24, lines 37 – 43];

a memory access error input [memory access error; col. 31, lines 26 – 35];

an active virtual machine identification output [active partition ID is maintained by a single partition register 1746; col. 30, lines 55 – 67]; and

a memory access location output [FieldOffset field, along with the objectref pointer, identifies a location in memory of the field; col. 13, line 65 – col. 14, line 9]; and

an external memory protection component [PMU enforces memory protection constraints and contains the watchdog timers that enforce the context switches that change the partitions; col. 27, lines 23 – 30], not located on said integrated circuit chip, comprising an active virtual machine identification input and a memory access location

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input [col. 27, lines 30 – 42], said active virtual machine identification input coupled [col. 27, lines 30 – 42] with said active virtual machine identification output [col. 27, line 60 – col. 28, line 3] and said memory access location input coupled with said memory access location output of said integrated circuit chip [PMU 1700, Fig. 17; col. 29, lines 28 – 39], said external memory protection component comprising a memory access error output [col. 31, lines 25 – 35], said memory access error output coupled with said memory access error input [col. 31, lines 35 – 40];

wherein said external memory protection component indicates a memory access error via said memory access error output when said memory access location input indicates memory location not associated with a virtual machine identified by said active virtual machine identification output [col. 31, lines 35 – 56].

9. As to claim 2, Gee teaches said running step comprises running at least two Java virtual machines [col. 23, line 65 – col. 24, line 18 and col. 23, lines 18 – 29].

10. As to claim 3, Gee teaches activating a specific independent virtual machine of said plurality of independent virtual machines [col. 25, lines 40 – 50].

11. As to claim 4, Gee teaches using a timer to define an activation period of an activated virtual machine [col. 28, lines 52 – 67].

12. As to claim 5, Gee teaches assigning a memory region to at least one independent virtual machine of the plurality of independent virtual machines [Preparation involves allocation of static storage and the creation of any data structures, such as method tables, that are used internally by the JVM; col. 6, lines 13 – 26].

13. As to claim 6, Gee teaches protecting a virtual machine's memory region from accesses by a different virtual machine [col. 27, lines 23 – 30].

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14. As to claim 7, Gee teaches screening a memory access [col. 27, line 60 – col. 28, line 2]; and generating an abort interrupt signal to abort an access to a memory region of a nonactivated virtual machine [col. 28, line 3 – 13].

15. As to claim 8, Gee teaches outputting the identity of the activated virtual machine to a memory management component [active partition ID is maintained by a single partition register 1746; col. 30, lines 55 – 67].

16. As to claim 9, Gee teaches identifying, by the memory management component, the memory region assigned to the activated virtual machine [col. 30, lines 27 – 45].

17. As to claim 10, Gee teaches monitoring address lines to abort attempted memory accesses to a protected memory region [col. 27, line 60 – col. 28, line 2].

18. As to claim 11, Gee teaches aborting an attempted access to a protected memory region by generating an error signal [col. 31, lines 35 – 40].

19. As to claim 12, Gee teaches aborting an attempted access to a protected memory region by generating a prioritized nonmaskable interrupt signal [col. 28, lines 45 – 51].

20. As to claim 13, Gee teaches aborting an attempted access to a protected memory region by generating a highest priority [col. 21, lines 6 – 8] prioritized nonmaskable interrupt signal [col. 28, lines 45 – 51].

21. As to claim 14, Gee teaches receiving a maskable interrupt signal [col. 28, lines 3 – 15].

22. As to claim 15, Gee teaches latching a received maskable interrupt signal [col. 31, lines 57 – 64].

23. As to claim 16, Gee teaches latching a received maskable interrupt signal into a virtual interrupt latch component even though the independent virtual machine with which it is associated is not the activated independent virtual machine at the time the received maskable interrupt signal is received [col. 31, line 57 – col. 32, line 6].

24. As to claim 17, Gee teaches transferring the maskable interrupt signal, upon activation of its associated virtual machine, from the virtual interrupt latch component to a global interrupt mask register [col. 32, lines 7 – 31].

25. As to claim 18, Gee teaches transferring the maskable interrupt signal, upon activation of its associated virtual machine, from the virtual interrupt latch component [col. 32, lines 7 – 31] to a local mask register [col. 15, lines 33 – 37].

26. As to claim 19, Gee teaches sending the maskable interrupt signal, upon activation of its associated virtual machine [col. 32, lines 7 – 31], to a priority encoder after said steps of transferring and communicating [col. 10, lines 40 – 50].

27. As to claim 20, Gee teaches holding the received maskable interrupt signal in the virtual interrupt latch component until the independent virtual machine with which it is associated has been activated [col. 31, line 57 – col. 32, line 6]; and servicing the received maskable interrupt signal during the time period that its associated independent virtual machine has been activated [col. 32, lines 7 – 31].

28. As to claim 21, Gee teaches discerning whether the independent virtual machine associated with the received maskable interrupt signal is the activated independent virtual machine; and ignoring the received maskable interrupt signal if it is discerned that the independent virtual machine with which the received maskable interrupt signal is associated is not the currently activated independent virtual machine [col. 28, lines 52 – 67].

29. As to claim 22, Gee teaches receiving a nonmaskable interrupt signal [col. 25, lines 19 – 29].

30. As to claim 23, Gee teaches receiving a nonmaskable interrupt signal indicating a power supply interruption [col. 26, lines 18 – 30].

31. As to claim 24, Gee teaches receiving a nonmaskable interrupt signal indicating activation of a different independent virtual machine [col. 28, lines 45 – 52].

32. As to claim 25, Gee teaches receiving a nonmaskable interrupt signal indicating an application specific event [col. 23, lines 30 – 43 and col. 24, lines 54 – 65].

33. As to claim 26, Gee teaches receiving a nonmaskable interrupt signal indicating a prohibited memory access attempt [col. 28, lines 3 – 13].

34. As to claim 27, Gee teaches reserving the highest priority for interrupt signals indicating a prohibited memory access attempt [col. 21, lines 6 – 8]; and wherein said receiving step comprises receiving a nonmaskable interrupt signal indicating a prohibited memory access attempt [col. 28, lines 3 – 13].

35. As to claim 28, Gee teaches suspending execution of the activated independent virtual machine upon receipt of a nonmaskable interrupt signal indicating a prohibited memory access attempt [col. 31, lines 44 – 49].

36. As to claim 30, Gee teaches interrupt controller component further comprises a plurality of virtual interrupt latch components [col. 10, lines 43 – 57].

37. As to claim 31, Gee teaches a plurality of global interrupt mask registers [a mask to the interrupt controller; col. 10, line 57 – col. 11, lines 9].

38. As to claim 32, Gee teaches a plurality of global interrupt mask registers, and wherein each global interrupt mask register is coupled with one of the virtual interrupt latch components [col. 20, line – col. 21, line 5].

39. As to claims 33 and 36, Gee teaches a local mask register coupled with said plurality of global interrupt mask registers [col. 15, lines 33 – 37].

40. As to claims 34 and 37, Gee teaches a priority encoder coupled with said local mask register [col. 10, lines 43 – 50].

Response to Arguments

41. Applicant's arguments filed 09/23/2005 have been fully considered but they are not persuasive. In response to the Non-Final Office Action dated 03/18/2005, applicant argues:

(1) Gee does not disclose multiple virtual machines run concurrently on a single, real-time, embedded processor system [p. 13, lines 18 – 20]; and

(2) Gee does not specify that designated components are resident on a single integrated circuit chip [p. 13, line 21 - p. 14, line 1].

In response to argument (1), examiner respectfully disagrees and notes that Gee teaches multiple virtual machines run concurrently on a single [context switch operation is used to implement multiple JVMs which operate concurrently on a single processor; col. 23, lines 19 – 29], real-time, embedded processor system [col. 21, lines 43 – 50]. Gee specifically discloses a context switch operations that is used to implement multiple JVMs which operated concurrently on a single processor. Gee also teaches that the processor includes a priority scheduler that performs priority scheduling for a real-time embedded system [col. 21, lines 43 – 50].

As to argument (2), examiner respectfully disagrees and submits that Gee teaches executing multiple virtual machines in a real-time embedded system [col. 21, lines 43 – 57 and col. 33, lines 46 – 55]. Since embedded systems are built on a single

chip, real-time embedded system and its component as taught by Gee are also on a single chip.

Conclusion

42. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

CONTACT INFORMATION

43. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li B. Zhen whose telephone number is (571) 272-3768. The examiner can normally be reached on Mon - Fri, 8:30am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William Thomson can be reached on 571-272-3718. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Li B. Zhen

Examiner

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